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THE

ANNULAR ECLIPSE

OF

MAY 26, 1854.

PUBLISHED UNDER THE AUTHORITY OF

HON. JAMES C. DOBBIN,
SECRETARY OF THE NAVY,

BY THE

SMITHSONIAN INSTITUTION AND NAUTICAL ALMANAC.

WASHINGTON.
1854.

Wm R Ware
from his friend
Chauncey Wright

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By Exch.

CAMBRIDGE:
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USE OF THE TABLES.

THE tables of Data are adapted to very accurate computation by the following formulas:—

Let ϕ = latitude of the place
λ = its west. long. from Wash.
$\log e = 8.9110835$
$\log (1 - e)^2 = 9.9971066$
$\sin \phi' = e \sin \phi$

$h = \sec \phi' \cos \phi$
$k = (1 - e^2) \sec \phi' \sin \phi$
$a = A - h \sin (\mu - \lambda)$
$b = B - E k + G h \cos (\mu - \lambda)$
$c = - C + F k - H h \cos (\mu - \lambda)$
$m = \sqrt{b c}$

Find the time of the beginning or end of the eclipse approximately by the Chart, and if this determination be correct, m will be exactly equal to a. If m is not equal to a, a nearer approximation may be made by adding to this time an interval t, which may be obtained in seconds by the formulas

$\log. \mu' = 1.86167$
$\tan. \frac{1}{2} \psi = \frac{c}{m} = \frac{m}{b}$

$a' = A' - \mu' h \cos (\mu - \lambda)$
$b' = B' - \mu' G h \sin (\mu - \lambda)$

$$t = \frac{1000000(m - a)}{a' + b' \cot \psi}$$

ψ must be taken of the same sign with a, and is a sufficiently near approximation to the angle of contact from the north towards the east.

The magnitude of the eclipse is found by taking the difference (with regard to the signs) of ψ at the beginning and end of the eclipse, and if this difference is denoted by $2\,\theta$, the magnitude of the eclipse is

$$23.3 \sin^2 \tfrac{1}{2}\,\theta, \text{ or } 23.3 \cos^2 \tfrac{1}{2}\,\theta,$$

accordingly as θ is acute or obtuse.

The value of θ may also be obtained by the formulas

$$\tan \chi = \frac{b'}{a'} \qquad \theta = \psi + \chi$$

(in which χ has the sign of b').

Example. — To compute the beginning of the Eclipse for the National Observatory at Washington, we have

$\phi = + 38° 53' 39.''0$
$\log \sin \phi = 9.797880$

$\lambda = 0° 0' 0''$
$\log \cos \phi = 9.891150$

$\log \sin \phi' = 8.708964$

$\log \sec \phi' = 0.000569$
$\log k = 9.795556$

0.000569
$\log h = 9.891719$

We find from the Chart for the time of beginning $4^{h.}\ 3^{m.}$ Washington Mean Time, and from the Tables by interpolation for this time,

$A = +\ 0.12715$	$\log E = 9.970377$
$B = +\ 1.00644$	$\log F = 9.968823$
$C = -\ 0.11925$	$\log G = 9.552834$
$A' = +136.56$	$\log H = 9.563173$
$B' = +\ 39.22$	$\mu = 61^\circ\ 33'\ 51.7''$

Hence

$$\mu - \lambda = 61^\circ\ 33'\ 51.7''$$

$\log \cos (\mu - \lambda) = 9.677763$	$\log \sin (\mu - \lambda) = 9.944163$
$\log h \cos (\mu - \lambda) = 9.569482$	$\log h \sin (\mu - \lambda) = 9.835882$

$\log G\, h \cos (\mu - \lambda) =$	9.122316	$\log H\, h \cos (\mu - \lambda) =$	9.132655
$\log E\, k =$	9.765933	$\log F\, k =$	9.764379
$G\, h \cos (\mu - \lambda) =$	$+0.13253$	$-H\, h \cos (\mu - \lambda) =$	$-\ 0.13572$
$-E\, k =$	-0.58336	$F\, k =$	$+\ 0.58127$
$B =$	$+1.00644$	$-C =$	$+\ 0.11925$
$b =$	0.55561	$c =$	0.56480
$\log b =$	9.744770	$-h \sin (\mu - \lambda) =$	$-\ 0.68530$
$\log c =$	9.751895	$A =$	$+\ 0.12715$
$\log m =$	9.748333	$a =$	$-\ 0.55815$
$\log \tan \frac{1}{2} \psi =$	0.003562	$m =$	$-\ 0.56019$
$\psi =$	$-90^\circ\ 28'$	$m - a =$	$-\ 0.00204$
$\log \mu' h \cos (\mu - \lambda) =$	1.43115	$\log G\, \mu' h \sin (\mu - \lambda) =$	1.25038
$\mu' h \cos (\mu - \lambda) =$	26.99	$G\, \mu' h \sin (\mu - \lambda) =$	17.80
$a' =$	$+109.57$	$b' =$	21.42
$a' + b' \cot \psi =$	109.74	$\log b' =$	1.33082
$\log 10^6 (m - a) =$	$3.30963n$	$\log \cot \psi =$	7.91089
$\log (a' + b' \cot \psi) =$	2.04037	$b' \cot \psi =$	$+\ 0.17$
$\log t =$	$1.26926n$		

	h.	m.	s.
Assumed Time	4	3	0.0
t			—18.6
Washington Mean Time of beginning (Observatory)	4	2	41.4

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	h.	m.	s.
Eclipse ends at Washington	6	27	29.4
First angle of contact			—90°
Last angle of contact			+73°
Number of digits			9.9

At Cambridge, where the annulus will be visible,

	h.	m.	s.	
Eclipse begins	4	26	53.4	Cambridge Time.
Eclipse ends	6	47	6.9	" "
First angle of contact				—98°
Last angle of contact				+81°

	h.	m.	s.
Annulus begins	5	39	46.7
Annulus ends	5	42	21.1
Annulus lasts		2	34.4
First angle of contact			—51°
Last angle of contact			+33°

TABLES.

DATA FOR COMPUTING THE ECLIPSE FOR ANY PLACE, FOR PENUMBRA.

Wash. M. Time.	A.	B.	C.	log E.	log F.	log G.	log H.	μ
h.				9.970	9.968	9.552	9.562	° ′ ″
0.6	—1.56981	+0.51714	—0.60840	445	893	365	717	9 48 50.2
0.7	1.52064	0.53138	0.59417	443	891	379	730	11 18 50.3
0.8	1.47143	0.54562	0.57994	441	889	393	743	12 48 50.3
0.9	1.42222	0.55986	0.56571	439	887	406	757	14 18 50.4
1.0	1.37302	0.57409	0.55149	437	885	420	770	15 48 50.4
1.1	1.32381	0.58832	0.53727	435	883	433	783	17 18 50.5
1.2	1.27461	0.60254	0.52305	433	881	447	796	18 48 50.5
1.3	1.22541	0.61676	0.50884	431	879	461	810	20 18 50.5
1.4	1.17621	0.63098	0.49463	429	877	474	823	21 48 50.6
1.5	1.12701	0.64519	0.48042	427	875	488	836	23 18 50.6
1.6	1.07781	0.65940	0.46622	425	873	501	849	24 48 50.7
1.7	1.02861	0.67361	0.45202	423	871	515	862	26 18 50.7
1.8	0.97941	0.68781	0.43782	421	869	529	876	27 48 50.8
1.9	0.93022	0.70201	0.42363	419	867	542	889	29 18 50.8
2.0	0.88102	0.71621	0.40944	417	865	556	902	30 48 50.8
2.1	0.83183	0.73040	0.39525	415	863	569	915	32 18 50.9
2.2	0.78264	0.74459	0.38107	413	861	583	929	33 48 50.9
2.3	0.73345	0.75878	0.36689	411	859	597	942	35 18 51.0
2.4	0.68426	0.77296	0.35271	409	857	610	955	36 48 51.0
2.5	0.63507	0.78714	0.33853	407	854	624	968	38 18 51.0
2.6	0.58588	0.80132	0.32436	405	852	637	981	39 48 51.1
2.7	0.53670	0.81549	0.31019	403	850	651	995	41 18 51.1
2.8	0.48751	0.82965	0.29603	401	848	664	*08	42 48 51.2
2.9	0.43833	0.84382	0.28187	399	846	678	021	44 18 51.2
3.0	0.38915	0.85798	0.26771	397	844	692	034	45 48 51.3
3.1	0.33997	0.87213	0.25355	395	842	705	047	47 18 51.3
3.2	0.29079	0.88629	0.23940	393	840	719	061	48 48 51.3
3.3	0.24161	0.90044	0.22525	391	838	732	074	50 18 51.4
3.4	0.19244	0.91458	0.21111	389	836	746	087	51 48 51.4
3.5	0.14327	0.92872	0.19697	387	834	759	100	53 18 51.5
3.6	0.09410	0.94286	0.18283	385	832	773	113	54 48 51.5
3.7	—0.04493	0.95700	0.16869	383	830	787	127	56 18 51.5
3.8	+0.00424	0.97113	0.15456	381	828	800	140	57 48 51.6
3.9	0.05341	0.98525	0.14043	379	826	814	153	59 18 51.6
4.0	0.10257	0.99938	0.12631	377	824	827	166	60 48 51.7
4.1	0.15173	1.01350	0.11219	376	822	841	179	62 18 51.7
4.2	0.20089	1.02761	0.09807	374	820	854	192	63 48 51.8
4.3	0.25005	1.04173	0.08395	372	818	868	206	65 18 51.8
4.4	0.29920	1.05583	0.06984	370	816	881	219	66 48 51.8
4.5	0.34836	1.06994	0.05573	368	814	895	232	68 18 51.9
4.6	0.39752	1.08404	0.04163	366	812	908	245	69 48 51.9
4.7	0.44667	1.09814	0.02753	364	810	922	258	71 18 52.0
4.8	0.49582	1.11223	—0.01343	362	808	935	271	72 48 52.0
4.9	0.54496	1.12632	+0.00067	360	806	949	285	74 18 52.0
5.0	0.59411	1.14040	0.01476	358	804	962	298	75 48 52.1
5.1	+0.64325	+1.15448	+0.02885	356	802	976	311	77 18 52.1

DATA FOR COMPUTING THE ECLIPSE FOR ANY PLACE, FOR PENUMBRA.

Wash. M. Time.	A.	B.	C.	log E.	log F.	log G.	log H.	μ
h.				9.970	9.968	9.552	9.563	° ′ ″
5.2	+0.69239	+1.16856	+0.04293	354	800	989	324	78 48 52.2
5.3	0.74153	1.18264	0.05701	352	798	*03	337	80 18 52.2
5.4	0.79066	1.19671	0.07109	350	796	016	350	81 48 52.2
5.5	0.83980	1.21077	0.08516	348	793	030	363	83 18 52.3
5.6	0.88893	1.22483	0.09923	346	791	043	377	84 48 52.3
5.7	0.93806	1.23889	0.11330	344	789	057	390	86 18 52.3
5.8	0.98718	1.25295	0.12736	342	787	070	403	87 48 52.4
5.9	1.03631	1.26700	0.14142	340	785	084	416	89 18 52.4
6.0	1.08543	1.28104	0.15548	338	783	097	429	90 48 52.5
6.1	1.13455	1.29508	0.16953	336	781	111	442	92 18 52.5
6.2	1.18366	1.30912	0.18358	334	779	124	455	93 48 52.5
6.3	1.23278	1.32316	0.19762	332	777	138	468	95 18 52.6
6.4	1.28189	1.33719	0.21166	330	775	151	481	96 48 52.6
6.5	1.33100	1.35121	0.22570	328	773	165	494	98 18 52.7
6.6	+1.38010	+1.36524	+0.23974	326	771	178	508	99 48 52.7

FOR SHADOW.

Washington Mean Time.	B.	C.	Washington Mean Time.	B.	C.
h.			h.		
1.5	+0.09923	+0.06554	3.6	+0.39690	+0.36314
1.6	0.11344	0.07974	3.7	0.41103	0.37727
1.7	0.12765	0.09394	3.8	0.42516	0.39140
1.8	0.14185	0.10814	3.9	0.43929	0.40553
1.9	0.15605	0.12234	4.0	0.45341	0.41966
2.0	0.17025	0.13653	4.1	0.46753	0.43378
2.1	0.18444	0.15071	4.2	0.48165	0.44790
2.2	0.19863	0.16490	4.3	0.49576	0.46201
2.3	0.21281	0.17908	4.4	0.50987	0.47612
2.4	0.22700	0.19326	4.5	0.52397	0.49023
2.5	0.24118	0.20743	4.6	0.53807	0.50434
2.6	0.25535	0.22160	4.7	0.55217	0.51844
2.7	0.26952	0.23577	4.8	0.56626	0.53254
2.8	0.28369	0.24994	4.9	0.58035	0.54663
2.9	0.29785	0.26410	5.0	0.59444	0.56072
3.0	0.31201	0.27826	5.1	0.60852	0.57481
3.1	0.32617	0.29241	5.2	0.62260	0.58889
3.2	0.34032	0.30656	5.3	0.63667	0.60297
3.3	0.35447	0.32071	5.4	0.65074	0.61705
3.4	0.36862	0.33486	5.5	0.66481	0.63113
3.5	0.38276	0.34900	5.6	0.67887	0.64520
3.6	+0.39690	+0.36314	5.7	+0.69293	+0.65926

A, μ, log E and log F are given in the Table for Penumbra, and the values of log G and log H are obtained from corresponding values for Penumbra by increasing log G and diminishing log H by 0.000025.

CHANGES OF THE QUANTITIES IN THE TABLES OF DATA.

Washington Mean Time.	For one Minute.			For one Second.		
	A.	B.	C.	A′.	B′.	C′.
h.						
0.6	+8201.3	+2374.2	+2372.0	+136.69	+39.57	+39.53
0.9	8200.9	2372.3	2370.6	136.68	39.54	39.51
1.2	8200.4	2370.4	2369.1	136.67	39.51	39.48
1.5	8199.9	2368.7	2367.5	136.66	39.48	39.46
1.8	8199.4	2366.9	2365.9	136.66	39.45	39.43
2.1	8198.8	2365.2	2364.3	136.65	39.42	39.40
2.4	8198.2	2363.4	2362.8	136.64	39.39	39.38
2.7	8197.5	2361.5	2361.2	136.63	39.36	39.35
3.0	8196.7	2359.7	2359.5	136.61	39.33	39.32
3.3	8195.9	2357.8	2357.8	136.60	39.30	39.30
3.6	8195.1	2356.0	2356.2	136.58	39.27	39.27
3.9	8194.2	2354.2	2354.5	136.57	39.24	39.24
4.2	8193.3	2352.3	2352.8	136.55	39.20	39.21
4.5	8192.3	2350.4	2351.1	136.54	39.17	39.18
4.8	8191.3	2348.5	2349.4	136.52	39.14	39.16
5.1	8190.2	2346.6	2347.7	136.50	39.11	39.13
5.4	8189.0	2344.6	2345.9	136.48	39.08	39.10
5.7	8187.9	2342.7	2344.1	136.46	39.04	39.07
6.0	8186.7	2340.7	2342.3	136.44	39.01	39.04
6.3	8185.5	2338.8	2340.6	136.42	38.98	39.01
6.6	+8184.1	+2336.8	+2338.9	+136.40	+38.95	+38.98

CHART
THE
ANNULAR ECLIPSE
OF MAY 26TH 1854.

[illegible] the
HON. J. C. DOBBIN
Secretary of the Navy by
Charles Henry Davis.
Lieut. U.S.N. Supt. Naut. Almanac